



# Forest Insect & Disease Management

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## BIOLOGICAL EVALUATION OF SOUTHERN PINE BEETLE INFESTATIONS ON THE FRANCIS MARION-SUMTER NATIONAL FORESTS, SOUTH CAROLINA

By

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### ABSTRACT

Southern pine beetle (*Dendroctonus frontalis*) activity is increasing on National Forest districts in South Carolina. Aerial sketch map surveys of 565,263 acres and subsequent ground checks of National Forest lands show beetle activity threatens over 1/2 million acres of host type on the forests. Unfavorable red:green tree ratios and attack:emergence ratios from bark samples indicate that infestations should persist at about their current intensity into 1980. A southern pine beetle control project is recommended.

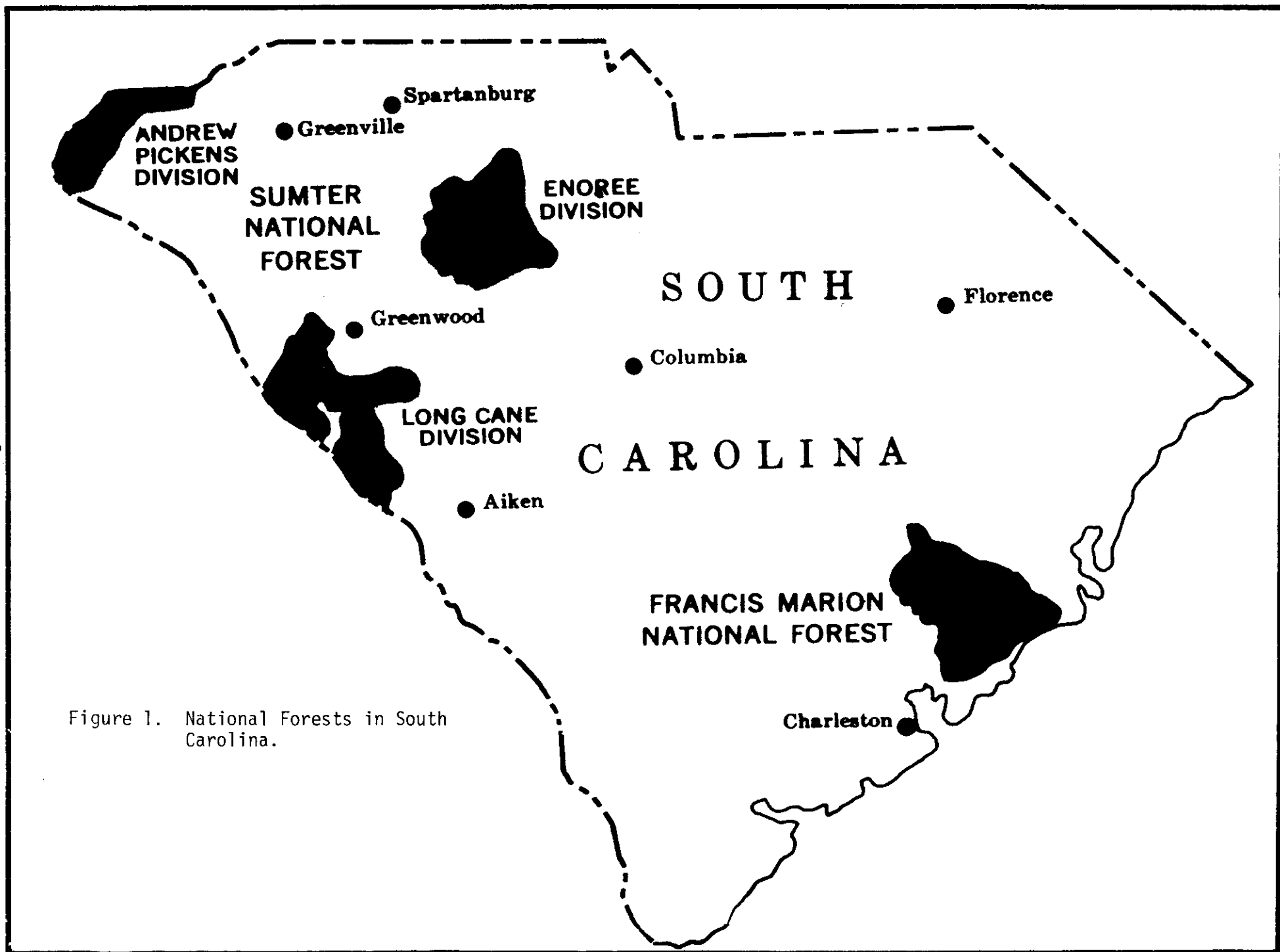
### INTRODUCTION

Biological evaluations were made on National Forest land in South Carolina (Fig. 1) to determine the status of southern pine beetle populations, and possible need for suppression and what type of suppressive measures to take, if required.

Historically, the National Forests of South Carolina have experienced two epidemic populations since 1963. Outbreaks have taken approximately 2 years to peak then they rapidly collapse the following year (Fig. 2).

If the current outbreak follows those of the past, the current outbreaks should continue to build through 1980 to their highest levels and then collapse sometime in 1981. The Francis Marion may be a year behind the western districts and may only be at the start of a 3-year increase.

**SOUTHEASTERN AREA, STATE & PRIVATE FORESTRY  
USDA FOREST SERVICE, ATLANTA, GA 30309**



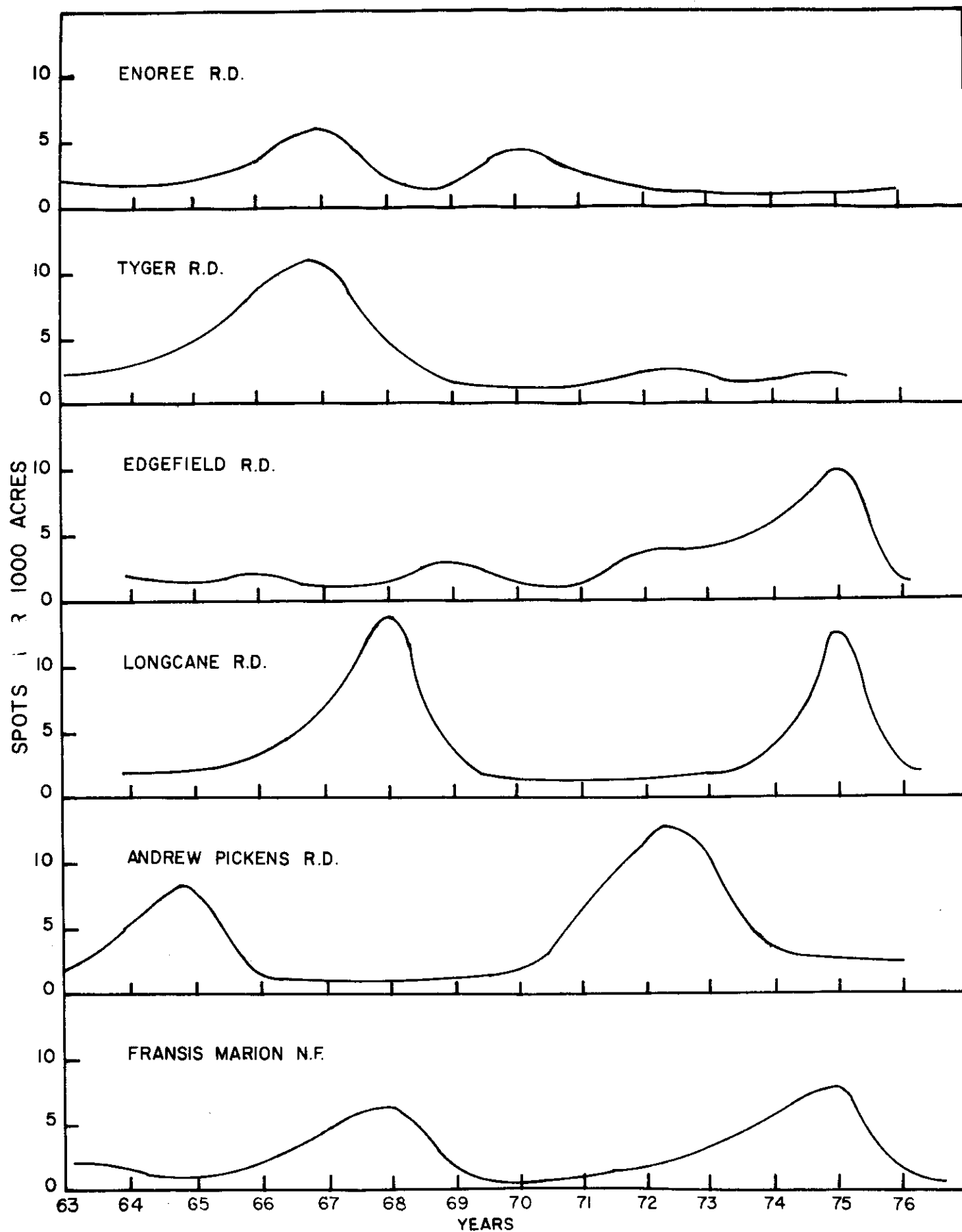


Fig. 2. Periodic fluctuations in southern pine beetle populations in South Carolina National Forests from 1963 - 1976.

## METHODS

Standard aerial sketch map surveys of both National Forests in South Carolina were made by personnel of the Aerial Survey Team, Forest Insect and Disease Management, Doraville, Georgia. Table 1 shows dates of aerial surveys, forested acreage by district, acreage of susceptible host type by district and percent of aerial survey made. Sketch maps were forwarded to the Asheville Field Office, State and Private Forestry, Forest Insect and Disease Management. Spots were stratified by size class and random spot selections for ground checking were made proportionate to size class distributions.

Data collected at each infestation included the number of currently infested trees, the number of red and green trees, and volume data for calculation of economic impact and benefit cost analysis (see economic evaluation). Additionally, if bark conditions permitted, three to five bark samples from recently vacated trees were taken near the active head of each spot. These samples were then taken to the laboratory, X-rayed, and the attack:emergence ratio determined. The attack:emergence ratio is an accepted indicator of individual infestation vitality. This methodology is being used only on a trial basis; further analysis and evaluation must be made before it can be used as an area-wide indicator of outbreak vitality. Data were compiled by district, forest, and finally for both National Forests in South Carolina.

## RESULTS

Table 2 shows expanded results of the aerial survey by spot size. That is, the 25 percent actual aerial survey data for a district were expanded by factor of 4.

Table 3 shows results of the ground checks listing number of spots and currently infested trees by size, class, red top to infested green tree ratio, and average A:E ratio by district, forest, and total for both Forests.

The following is a synopsis by Ranger Districts:

Long Cane: At survey time, this District was moderately infested at the southern end, particularly in McCormick County (fig. 3). Greenwood County was also moderately infested but Abbeville County had only a few small spots.

Edgefield: Most spots were in Edgefield County and were concentrated around the Clark Hill Reservoir. Few spots were detected in Greenwood and Saluda Counties. The Long Cane and Edgefield Districts shared very similar A:E ratios and R:G ratios, about 1:4.5 and 3.0:1, respectively.

Table 1. -- National Forests and Districts in South Carolina  
 Dates aerially furveyed, size susceptible acreage,  
 and percent coverage

Nat. Forest	District	Date Surveyed	Actual Acreage N.F.	Susceptible Acreage	% Survey
Sumter N. F.	Long Cone	7/23/79	50,216	44,075	25
	Edgefield	7/23/79	78,356	72,227	25
	Tyger	8/13/79	78,709	65,072	25
	Enoree	8/13/79	78,630	72,272	25
	Andrew Pickens	8/13/79	72,553	46,566	50
Francis Marion	Wambaw	8/17/79	130,686	128,097	25
	Witherbee	8/17/79	76,113	86,986	25
South Carolina National Forests	All	---	565,263	515,295	--

Tyger: This District (Fig. 4) was the most heavily infested with 3.7 spots/1000 acres host type. It also had one of the highest proportions of red to green infested trees (about 1:1).

Enoree: Conditions of the Enoree District were similar to those on the Tyger. The Enoree also showed the most spots in the 50+ category of any District surveyed.

Andrew Pickens: The Andrew Pickens (Fig. 5) is another heavily infested District. A high proportion of red to green trees and a moderate proportion of emerging to attacking beetles signifies a persistent infestation.

Two very active southern pine beetle spots were found on the edge of a Rare II area along side the road just north of #710 Tamassee Road and the other just east of #107. Due to the high biological potential of these spots to increase and cause further losses, Forest Insect and Disease Management feels that each of these spots should be controlled. These spots are on the edge of the road and very accessible with minor damage to the forest and the local environment.

Wambaw and Witherbee: (Fig. 6) Although less heavily infested than other Districts, the widely dispersed and growing spots could foreshadow serious problems in 1980.

This evaluation shows that approximately 71,406 trees containing 5,476,840 bd. ft. have been attacked and killed by the southern pine beetle. The volume protected for existing spots was calculated to be 8554.7 MBF (see benefit/cost analysis).

## RECOMMENDATIONS

1. A control project should be begun to reduce southern pine beetle populations. Depending on individual spot situations, any one of four methods may be used:

- a. Removal of Infested Trees by Commercial Sale or Administrative Use. When infested trees of merchantable size are accessible, they should be removed by commercial sale or administrative use procedures. Logging of the infested material should begin immediately. Contract time limits should insure rapid removal.

When practical, and if host type is present, a 40- to 70-foot buffer strip should be marked and cut adjacent to and ahead of the most recently infested trees. This practice is effective in reducing the

Table 2. -- Spot size distribution on National Forests in South Carolina  
Expanded Aerial Survey Data

National Forest	District	----- No. of spots by size class-----				Totals	No. spots/1000 ac. susceptible host type
		2 - 5	6 - 20	21 - 50	50 +		
Sumter	Long Cane	16	44	16	4	80	1.81
	Edgefield	28	48	20	16	112	1.55
	Tyger	72	60	96	12	240	3.70
	Enoree	44	136	60	20	260	3.60
	Andrew Pickens	20	14	16	4	54	1.16
	Total	180	302	208	56	746	2.48
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Francis Marion	Wambaw	32	4	-	-	36	0.28
	Wetherbee	24	12	4	-	40	0.45
	Total	56	16	4	-	76	0.35
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South Carolina	Grand Total	236	318	212	56	822	1.59

Table 3. SPB ground check information - Francis Marion and Sumter National Forests.

## Spot Size Category

National Forest	District	2 - 5		6 - 20		21 - 50		50 +		Totals		Ratio Red - Green	A:E Ratio
		Spots	Trees	Spots	Trees	Spots	Trees	Spots	Trees	Spots	Trees		
Sumter	Long Cane	-		2	25	3	74	-		5	99	3.0:1	1:4.79
	Edgefield	-		2	25	-		3	481	5	506	2.9:1	1:4.50
	Tyger	-		2	18	2	84	3	561	7	683	1.9:1	1:4.42
	Enoree	-		-		3	117	4	836	7	953	3.5:1	1:4.55
	Andrew Pickens	1	4	3	42	1	44	6	826	11	916	1.2:1	1:6.01
	Total	1	4	9	110	9	319	16	2704	35	3137	2.5:1	1:4.57
Francis Marion	Wambaw	-		1	11	1	29	-		2	40	1.8:1	1:5.89
	Witherbee	-		-		1	34	2	269	3	303	1.8:1	1:3.10
	Total	-		1	11	2	63	2	269	5	343	1.8:1	1:4.47
South Carolina National Forests	Grand Total	1	4	10	121	11	382	18	2973	40	3480	2.3:1	1:4.69



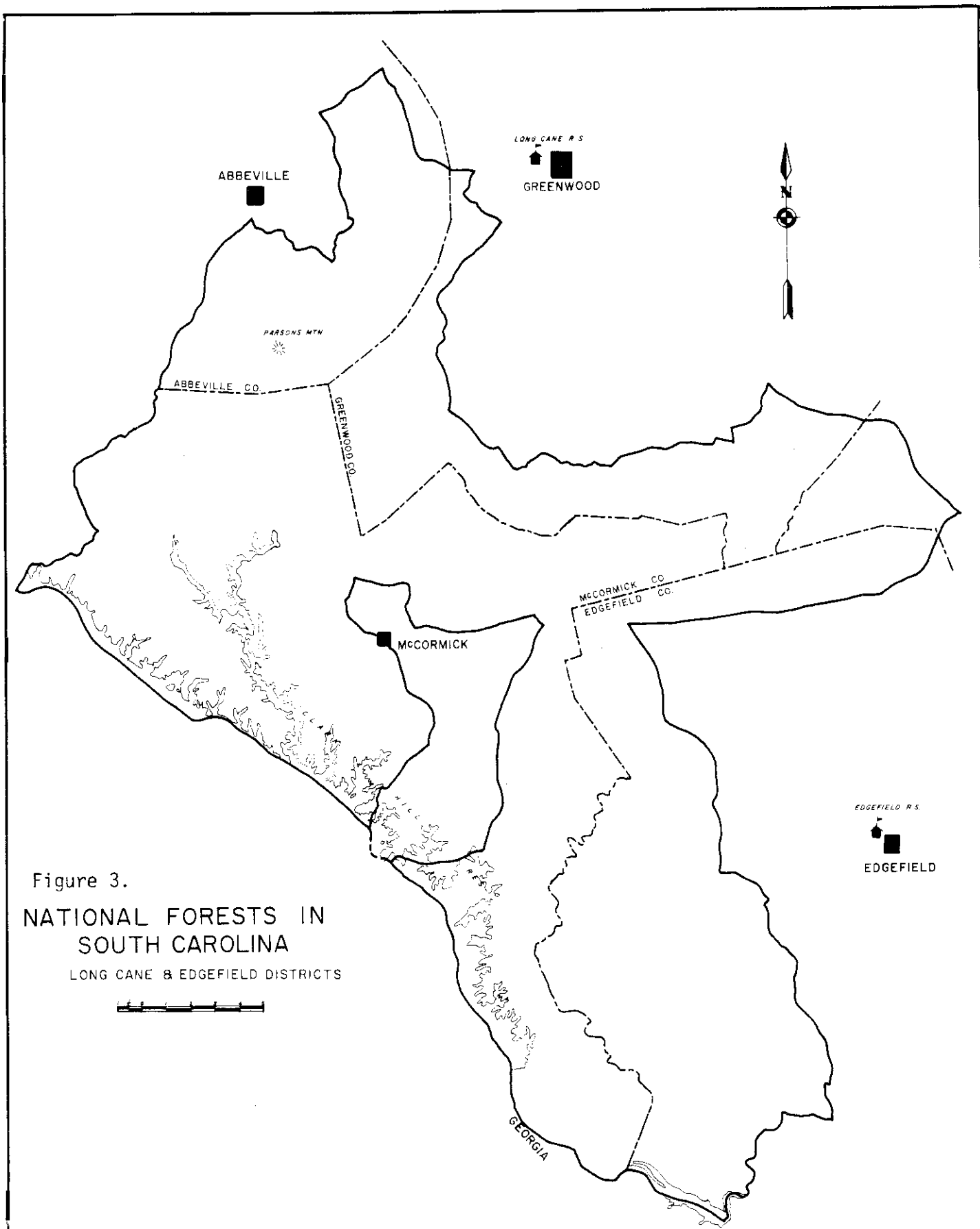
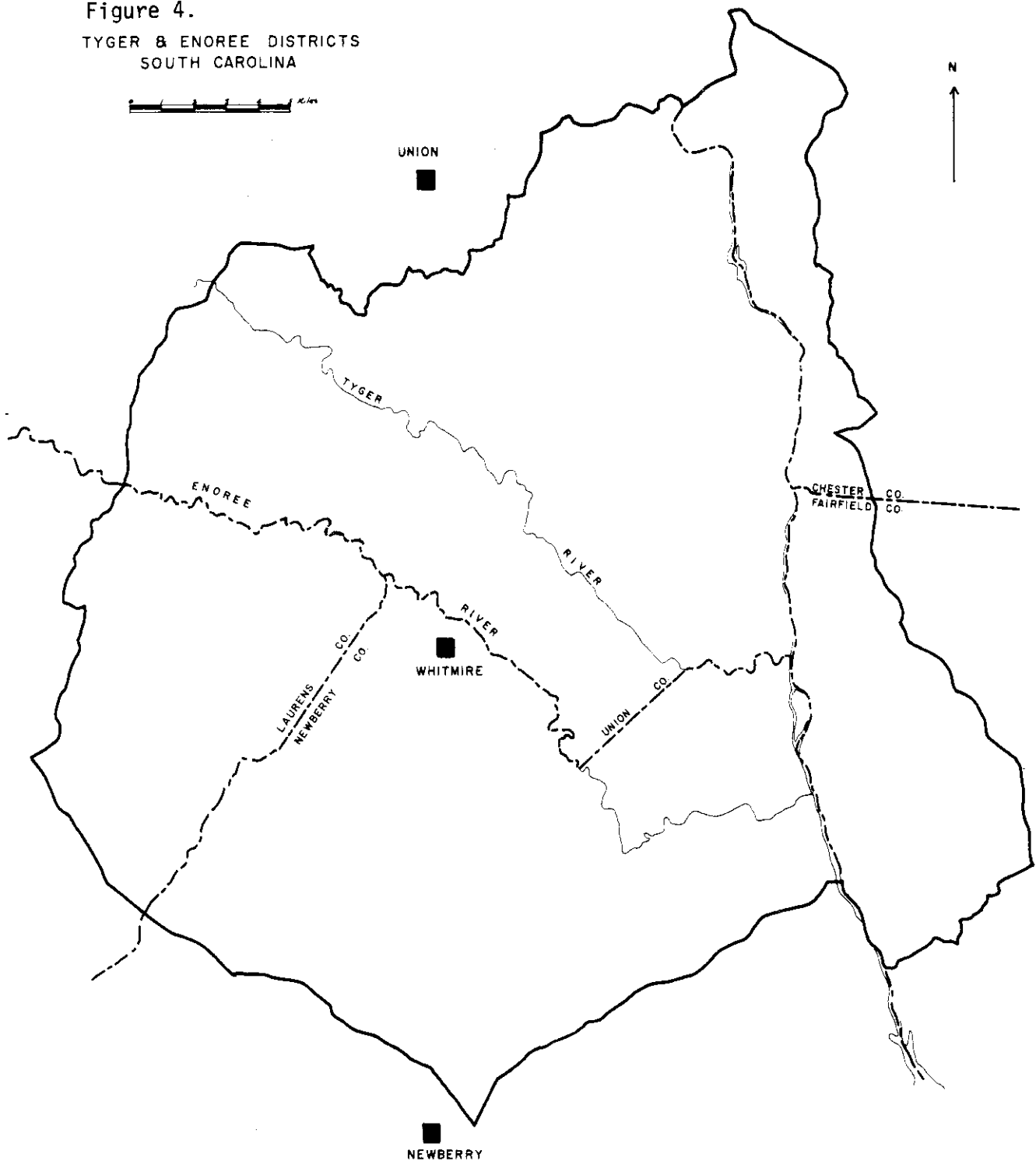


Figure 3.  
NATIONAL FORESTS IN  
SOUTH CAROLINA  
LONG CANE & EDGEFIELD DISTRICTS

Figure 4.

TYGER & ENOREE DISTRICTS  
SOUTH CAROLINA



possibility of "breakouts." When only a small volume of infested merchantable material occurs in a spot, noninfested trees surrounding the spot may be marked to provide an operable cut.

The order of priority for removing beetle infested timber from a spot should be as follows:

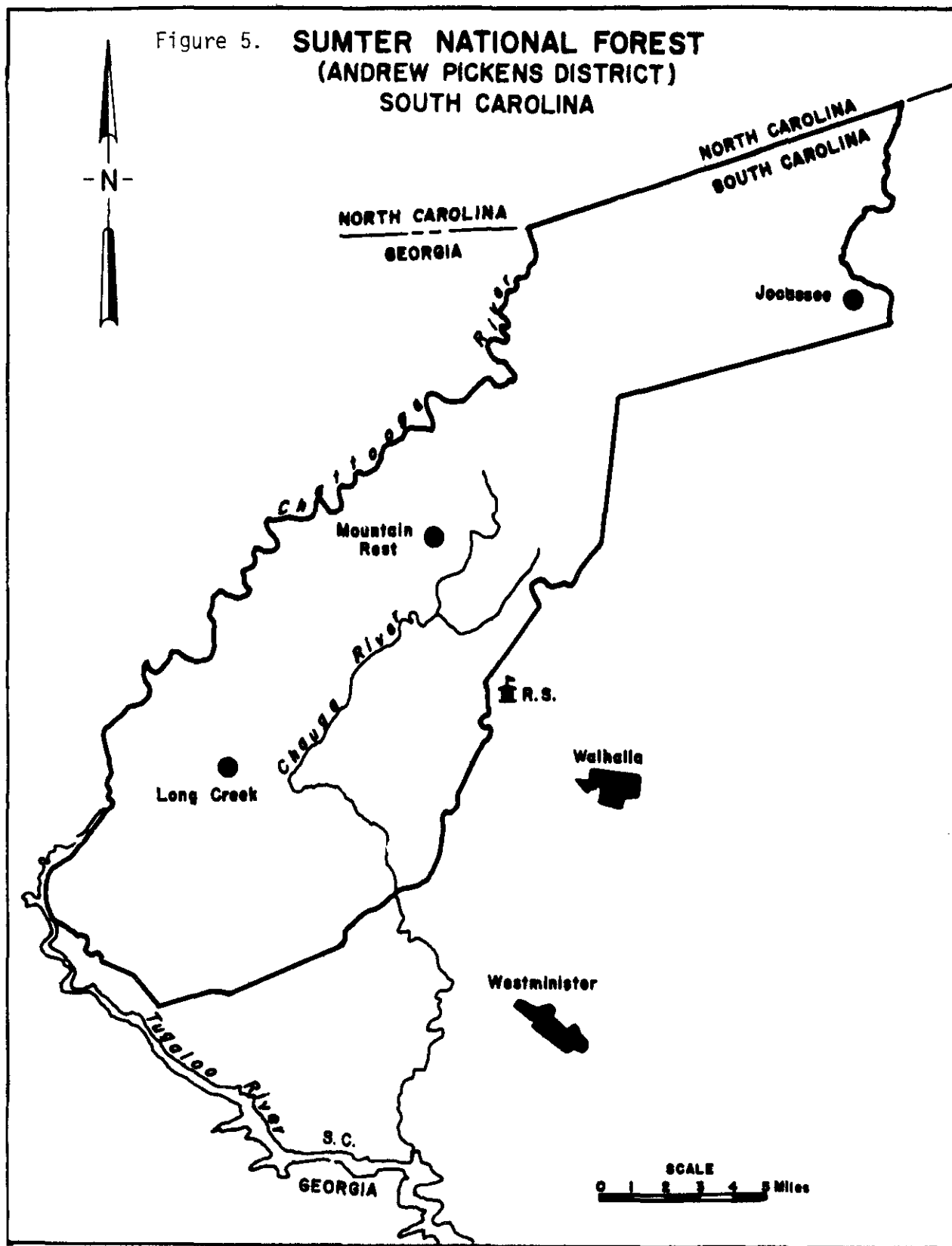
- Trees in the buffer zone at the head(s) of the spot - if not removed within 2 weeks of marking, another visit and tally must be made in order to insure removal of all infested trees and an adequate buffer strip.
- Trees with fresh attacks and having young broods (usually the green, recently infested trees).
- Trees having nearly developed broods (usually the red and fading trees).

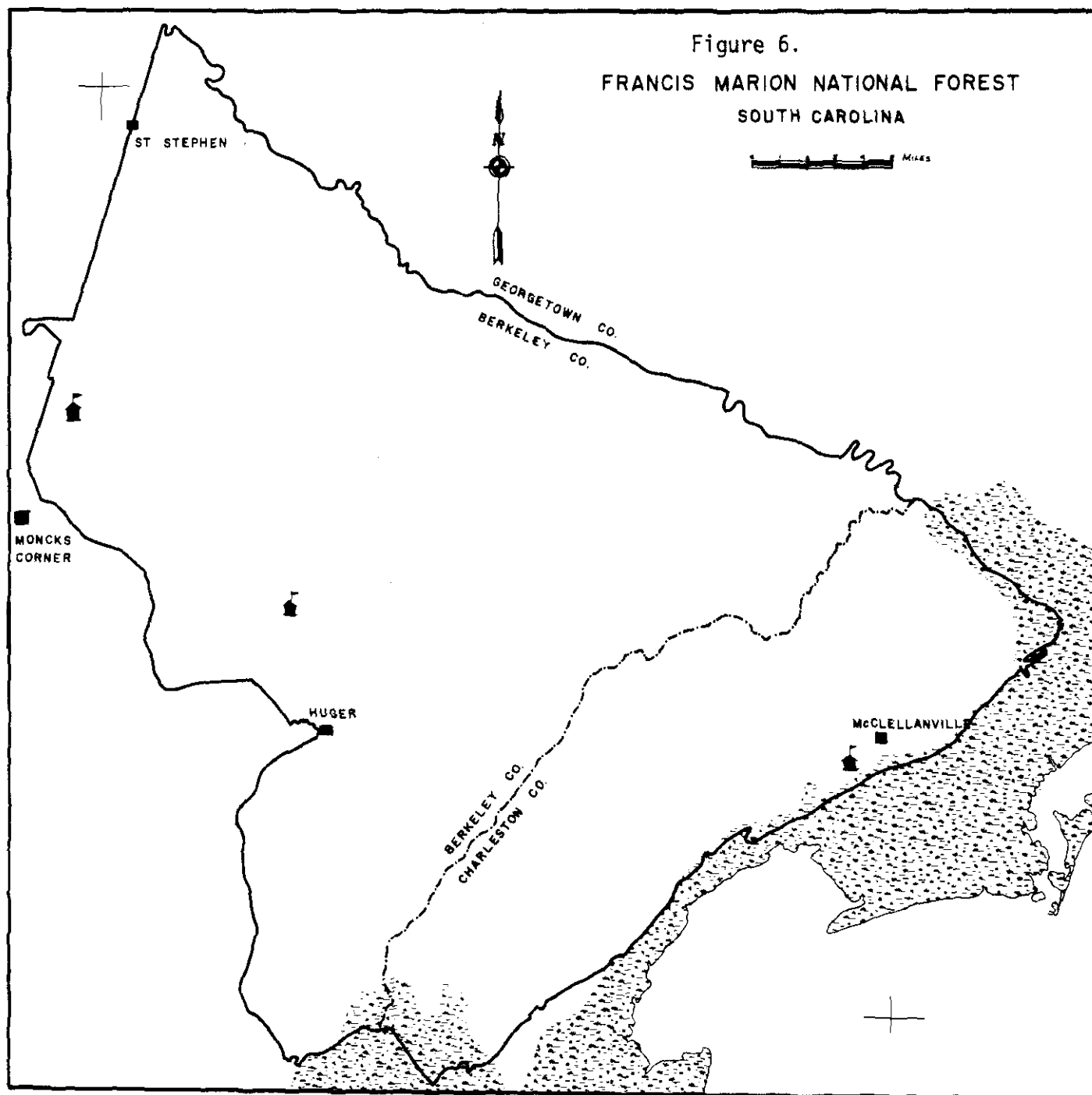
Remove infested trees from National Forest lands by commercial sale or administrative procedure in accordance with guidelines and procedures set forth in FSM 2400 through 2490.

- b. Piling and Burning. Unmerchantable or inaccessible southern pine beetle infestations can be suppressed by cutting, piling, and thoroughly burning the bark of infested trees. The entire bark surface must be thoroughly burned to insure effective control. The side order of priority for cutting, piling, and burning infested trees, particularly the large spots, is the same as paragraph (1) under removal of infested trees by commercial sale or administrative use. Cutting a buffer strip is not recommended. To reduce the possibility of "breakouts" every effort should be made to locate and treat all green infested trees during the piling and burning operation.
- c. Chemical Control. Chemical formulation recommended for southern pine beetle control is a 1/2 percent lindane spray with No. 2 fuel oil as the carrier. This may be formulated from a 20 percent lindane emulsifiable concentrate or oil concentrate at the rate of 11 pints of concentrate in enough fuel oil to make 55 gallons of spray. (Ratio of one part 20 percent lindane EC to 39 parts No. 2 diesel fuel.)

Cut, limb, and buck all infested trees into workable lengths. Spray the infested bark surface to the point of runoff. A compressed air sprayer (3-gallon capacity or equivalent) is an ideal applicator. Infested logs must be turned two or three times to insure complete treatment of infested bark. Spray stumps and bark removed by woodpeckers. Low pressure sprayers may be used to treat large accessible infestations.

Figure 5. **SUMTER NATIONAL FOREST**  
**(ANDREW PICKENS DISTRICT)**  
**SOUTH CAROLINA**





The order of priority for cutting and spraying infested trees in large spots is the same as paragraph (1) under removal of infested trees by commercial sale or administrative use. Cutting a buffer strip is not recommended. To reduce the possibility of "breakouts" every effort should be made to locate and treat all green infested trees during the chemical control operation.

Never spray trees from which southern pine beetle brood has emerged. Natural enemies of the southern pine beetle in these trees can then complete their development. To prevent aerial spotters from mapping treated spots, cut trees with red needles from which beetles have emerged.

Instructions for minimizing the adverse effects of mixing, transporting and storing pesticides, applying pesticides and disposing of pesticide containers and excess chemicals are outlined in Section 8.3 of the Forest Service Health and Safety Code FSM 5242.21.

- d. Cut-and-leave. This control tactic reduced losses from spot growth and proliferation during the summer months. Cut-and-leave is designed to disrupt spot growth in small to medium-sized spots (40 active trees) by dispersing emerging beetles. These spots can be salvaged when markets or weather permit. Trees are still suitable for sale months after felling.

The following procedure is to be followed when cut-and-leave:

- (1) Identify all active trees within the spot.
- (2) Fell all active trees toward the center of the spot.
- (3) Fell a horseshoe-shaped buffer of green, uninfested trees around the most recently attacked trees at the head of the spot and leave them lying on the ground with crowns pointed toward the center of the spot. The buffer should be as wide as the average height of the trees in the stand.

Cut-and-leave treatments should only be applied during the summer months between June-October. Spots with 10 or more infested trees should be treated first. As time permits, spots with 10 infested trees should also be treated if they contain trees with recent fresh attacks. In these smaller infestations where a specific head is not distinguishable, an adequate buffer strip (equivalent to the average height of the stand) and all infested and green uninfested trees within the spot should be felled.

- e. Reexamination of Treated Areas. Reexamine areas where infested trees were removed by commercial sales, piled and burned, or chemically treated or cut and left within 2 or 3 weeks after treatment to check for additional infested trees. If additional trees are found, treat them.

2. In any area where infested trees are cut for chemical control or piling and burning or removed through commercial sales and administrative use procedures, stumps adjacent to living pine trees should be treated to control or prevent the root rot Fomes annosus.

Stands that have been previously thinned or have had a history of F. annosus infection, stumps should be treated with the competing fungus, Peniophora gigantea.

Stands that have no history of F. annosus and have never been thinned, the stumps should be treated with borax.

Southern pine beetle infested tree stumps cut during the period of May through August, and below 34° N. latitude do not have to be treated with either of the above materials. This is because few spores are formed during this period and high temperatures often kill spores that are produced. However, routine summer thinning in areas of southern pine beetle buildup is not recommended (Froelich, R. C., et al., 1977).

3. The preceeding represents only short term immediate control strategies. In the long term, preventative measures must be taken to help ward off further southern pine beetle infestations in noninfested stands. Some of the more significant preventative measures include:
  - (a) Preventing or minimizing littleleaf disease, a condition which predisposes these weakened trees to beetle attack. Depending on severity of infection, diseased trees may be removed during normal thinnings, on a 6-year cutting cycle or as soon as merchantable. In high-hazard areas or in replanting known little-leaf sites, use loblolly pine or a more resistant tree species, as opposed to shortleaf pine.
  - (b) Harvesting mature and overmature stands. Such stands are vulnerable to beetle attack and should be harvested as soon as possible.
  - (c) Thinning stagnated stands. Overstocked stands are low in vigor and are more likely to be attacked. They should be thinned to a point that trees again show thrift and vigor.
  - (d) Minimizing impact of natural disturbances which cause stand stress. These factors include ice, wind, hail, and animal damage, flooding, erosion, poor soil fertility, etc. Corrective measures include removal of individual damaged trees, wholesale salvage, improving drainage, fertilization, etc.
4. All forest personnel should be informed of the problem and instructed to maintain constant surveillance for southern pine beetle activity. All sightings should be reported to the control project foreman.

5. The Aerial Survey Team and Asheville Field Office should reevaluate this area in the spring of 1980.
6. Minimizing or eliminating man-caused disturbances. Logging, pipeline, sewerline, and powerline construction, and other construction activities require use of heavy equipment which causes tree skinning and soil compaction and significantly weakens trees. Efforts to minimize the damaging consequences of these activities can significantly reduce the possibility of their leading to southern pine beetle problems.

#### PRECAUTIONARY PESTICIDE USE STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key--out of reach of children and animals--away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you used for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

NOTE: Some states have restrictions on the use of certain pesticides. Check your state and local regulations. Also, because registrations of pesticides are under constant review by the U. S. Department of Agriculture, consult your county agricultural agent or state extension specialist to be sure the intended use is still registered.